

LAWRENCE LIVERMORE REPORT

A weekly review of scientific and technological achievements from Lawrence Livermore National Laboratory, May 23-27, 2011

A view to California's energy future



Reducing California's carbon emissions 80 percent below 1990 levels in the next 40 years is no easy task. But in a new report by the California Council on Science and Technology, the state can reach the 60 percent mark a little more easily.

The report, "California's Energy Future - The View to 2050," combines the results of a two-year study of California's energy future and assesses technology requirements for reducing greenhouse gas emissions to 80 percent below 1990 levels by 2050 -- as required by Executive Order S-3-05. The Lab's Jane Long and former Sandia Vice President Mim John serve as the co-chairs of California's Energy Future Committee and lead authors of the study.

To reach the aggressive goal, every existing building will either be retrofit to higher efficiency standards or replaced and 60 percent of light-duty vehicles will use electricity, so that the average fuel economy will be roughly 70 miles per gallon, the report states. Additionally, the electricity generating capacity of the state will be almost entirely replaced and then doubled with near zero-emission technology.

To read more, go to the [Web](#).

To the galaxy and beyond



Maffei 2 is the poster child for an infrared galaxy that is almost invisible to optical telescopes.

Astrophysicist Adam Stanford has waited 10 years to find out exactly how galaxies that are 5-10 billion light years away from Earth formed.

He and a team of collaborators have been awarded 766 hours of observing time on NASA's Spitzer Space Telescope to conduct an infrared imaging survey covering 100 square degrees of the sky.

The Spitzer Space Telescope is a space-borne observatory capable of studying objects ranging from our solar system to the distant reaches of the universe. Launched in 2003, the telescope is the final element in NASA's family of orbiting "Great Observatories," which includes the Hubble Space Telescope, the Compton Gamma-Ray Observatory and the Chandra X-Ray Observatory.

Stanford's area of study, the SPT-Spitzer Deep Field Survey, has already been studied by the South Pole Telescope in the millimeter-wave range, but he will be studying it in mid-infrared wavelengths, observing it with the Dark Energy Survey and in the X-ray by the XMM space telescope.

"The observing time will allow us to look at cosmology parameters like the age of the universe, and also at galaxy cluster evolution," said Stanford, who works in the Lab's Institute of Geophysics and Planetary Physics.

To read more, go to the [Web](#).

'Science on Saturday' gains a large following on UCTV



The Lab's popular lecture series "Science on Saturday" attracts large audiences when held each year at the Bankhead Theater. Now, the program is gaining a lot of attention online as well.

Videos of lectures were first aired on University of California Television (UCTV) in 2006. During the past year alone, there have been 1.4 million downloads. Since 2006, Science on Saturday programs have been viewed more than 2.8 million times, either from UCTV's Website, the YouTube channel and podcast downloads from the UC site and iTunesU.

In addition, Science on Saturday programs occupied 11 slots in UCTV's Top 20 downloads for April. And, iTunes has selected the Science on Saturday series as a "Noteworthy" feature on their iTunesU Website.

"This collaboration has added to the public's awareness of the University, the Lab and the excitement of scientific discovery," said Bruce Darling, executive vice president for management oversight for the University of California.

To view Science on Saturday lectures on UCTV, go to the [Web](#).

Water and electricity do mix



This illustration shows the positive (red), zero (green), and negative (purple) regions of the ab initio electrostatic potential.

Some would say that water and electricity don't exactly work well together. But not so, according to Laboratory scientists and colleagues from Pacific Northwest National Laboratory.

An old confusion about the electrical properties of water arose because two types of measurements gave two radically different interpretations of what was happening at the surface of water.

The team showed, through careful analysis, that the measurements weren't wrong, rather the behavior of water's electrons influenced one measurement more than the other. The team's results provided a consistent interpretation of the different measurements.

While most people may not think of water as having electrical properties, when the behavior and movement of the electrons in this liquid comes into play in designing alternatives to today's

fossil fuels, water is often a critical component. The electrical forces that exist in water, a simple V-shaped molecule made from two hydrogen atoms and an oxygen atom, are vital to understanding and controlling how molecules, ions and other chemical components move and behave.

To read more, go to the [Web](#).

Climate research coming to Tracy students



(From left) Jason Noll, principal of Tracy High School; 12th grade students Matt Higa, Whitney Blackwell and Michael Wootten; and Dean Reese, physics teacher at Tracy High, accept a gift of \$7,500 from LLNS representative Cindy McAneney.

Through a \$7,500 gift from Lawrence Livermore National Security (LLNS), the entity that manages the Laboratory, students from the Tracy Unified School District have a much firmer grasp of the carbon cycle and its importance to climate change.

More than 200 students from Tracy High School and Kimball High School have been participating in a research project that focuses on analyzing carbon dioxide (CO₂) trapped in mustard plant leaves from the surface atmosphere.

Using Global Positioning System (GPS) devices and careful protocol, they collect samples of mustard leaves located within the Tracy area. These leaf samples are then brought to the Laboratory's Center for Accelerator Mass Spectrometry (CAMS) by Tracy High School physics teacher Dean Reese, who oversees the project. The samples are graphitized and analyzed for their isotopic concentrations; the data collected at CAMS is then brought back to the students for analysis.

Reese has been completing a Department of Energy teacher internship program called ACTS or Academies Creating Teacher Scientists, at CAMS with the help of mentor Tom Guilderson, a Laboratory senior research scientist.

To read more, go to the [Web](#).

LLNL applies and advances science and technology to help ensure national security and global stability. Through multi-disciplinary research and development, with particular expertise in high-energy-density physics, laser science, high-performance computing and science/engineering at the nanometer/subpicosecond scale, LLNL innovations improve security, meet energy and environmental needs and strengthen U.S. economic competitiveness. The Laboratory also partners with other research institutions, universities and industry to bring the full weight of the nation's science and technology community to bear on solving problems of national importance.

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